DESCRIPTION

Bleed valve

The invention relates to a bleed valve according to the preamble of claim 1.

Bleed valves of this type are normally configured for vertical installation into the wall of the fuel tank of a vehicle and are intended to provide a continuous connection between the inner chamber of the tank above a fuel level and the outside environment, so that in the open position, air is able to escape from the tank during the filling procedure and air can flow into the tank as fuel is consumed, in order to prevent a vacuum from building up. In the event that the tank is overfilled or that the position of the valve is substantially deviating from its usually topside position on the tank, said last condition indicating that an accident has occurred or that the vehicle has overturned going along with a risk that fuel may leak out in an uncontrolled manner the valve should be switched to its closed position. Therefore, in dependence upon the operating state of the tank or the vehicle, a facility for automatically switching the valve should be configured in a reliable manner between an open position and a closed position. In particular, characteristic vehicle movements which are determined by the drive operation are also to be taken into consideration for the operation of the valve.

A valve of this type is disclosed e.g. in DE 696 01 135. A floating body which cooperates with an elongate, strip-like, flexible membrane is disposed inside a cylindrical housing which on the base-side comprises inlet orifices and on the topside comprises an outlet orifice. The floating body can move axially inside the housing between an open and a closed position of the valve and is supported on the base-side by a spring. The movement of the floating body inside the housing and thus the switching position of the valve is thus determined quantitatively by the lifting force, which acts upon the floating body and is dependent upon the fuel level, by a mass force and by the force of the spring. On its side facing towards the floating body the outlet orifice which is configured in an elongate or slit-like manner forms with its rim a valve seat for the membrane which is fixed in the closed position of the valve between the valve seat, which extends in an

inclined manner with respect to the axis of the housing, and a counter surface of the floating body which extends in parallel with said valve seat. The membrane is secured merely at one end to the floating body. By reason of the inclined orientation of the valve seat and of the counter surface relative to the axis of the housing and thus the movement direction of the floating body, the opening procedure of the valve is characterised by the fact that the membrane becomes gradually detached from the valve seat.

US 6,240,950 discloses a bleed valve for a fuel tank, in which a floating body is disposed in a housing and supports on its topside a cylindrical attachment, from the planar topside of which a guide mandrel protrudes axially parallel with the axis of the housing with a conical transition region positioned therebetween. The guide mandrel passes through a central orifice of a sealing element which is supported on a support disc, on which a guide sleeve is integrally formed on the underside and engages around the outer side of the cylindrical attachment. On the free end of the guide sleeve an annular projection is integrally formed on the inner side and in cooperation with an annular projection integrally formed on the outer side on the upper end of the projection defines the axial displacement capability of the support disc and thus of the sealing element. The said housing is connected via inlet orifices to the inner chamber of the tank, so that according to the fluid level the floating body which is spring loaded on the underside is caused to float and furthermore until the sealing element lies against a valve seat which extends perpendicular to the longitudinal axis of the housing and issues into an outlet orifice. Although the connection of the support disc to the central attachment of the floating body ensures that the sealing element is able to move in a virtually cardanic manner with respect to the floating body, the sealing element and the valve seat normally extend, however, in parallel with each other by reason of the arrangement of the annular projections of the guide sleeve and the attachment which is concentric with respect to the longitudinal axis of the housing and this can render it more difficult for the sealing element to become detached from the valve seat.

US 4,753,262 discloses a further bleed valve for the fuel tank of a vehicle, in which a floating body which is supported on the base-side by a spring is disposed in such a manner as to be able to move axially in a cylindrical housing which is provided with base-side inlet orifices. The housing is provided with a topside outlet orifice, of which

the side facing towards the floating body forms a circular ring-shaped valve seat which is operatively connected to the membrane. Located on the topside of the floating body is a retaining element which forms a cage for the membrane and which is characterised by fingers which are disposed distributed uniformly in the peripheral direction and whose free ends the membrane is partially overlapped in the radial direction [sic]. In the axial direction of the housing the fingers comprise different lengths which are dimensioned with the proviso that in the event of a downwardly directed movement of the floating body which causes the outlet orifice to be revealed, the opening procedure begins at the point on the periphery of the outlet orifice which is allocated to the axially shortest finger so as to establish in turn an opening procedure which starts gradually. The valve seat extends similar manner to a counter surface of the floating body perpendicularly with respect to the axis of the housing.

Against this background, it is the object of the invention to provide a bleed valve of the generic type defined in the introduction such that an improved guiding effect is exerted upon the sealing element both during the opening movement and closing movement of the valve, in particular taking into account positional changes of the valve which result from the drive operation. In the case of a bleed valve of this type, this object is achieved by the features of the characterising portion of claim 1.

Accordingly, it is essential to the invention that in contrast to the prior art set forth in the introduction, it is not a surface which is structurally connected in a fixed manner to the floating body but rather the side of a support disc which faces towards the sealing element and for its part is articulated in a cardanic manner with respect to the floating body which acts as the counter surface for the sealing element. This means that positional changes, in particular inclined positions which result from the driving operation, can be compensated for in a defined frame, so that the sealing function is not impaired. In terms of material, the support disc will regularly differ in view of its function from the sealing element and consist of a less elastic material, preferably synthetic material, which is relatively harder in comparison with the sealing element. In contrast, the sealing element is subjected to a support effect which stabilises its configuration and accordingly can consist of a relatively softer material which is adapted to fulfil a sealing function. These measures lead to improved guidance of the sealing element whilst at the same time improving the integrity of the seal.

An opening procedure according to a non-uniform detachment of the sealing element from the valve seat which commences at a point on the periphery of the valve seat and progresses from this point is advantageous in order to reduce the expenditure of energy during opening and release of the valve and thus to improve its reliability. A cardanic articulation of the support disc is provided whilst at the same time taking into account the detachment of the sealing element which commences at a point on the periphery of the valve seat during opening of the valve. Therefore, one of the two pivot axes is characterised by an inclined position with respect to the axis of the housing. The other pivot axis extends perpendicularly with respect to the axis of the housing. In the event of a non-cylindrical housing the same applies in relation to the longitudinal extension thereof.

The housing and the floating body which is located therein can comprise a structure which is rotationally symmetrical in relation to a central axis, so that the floating body moves between the open and closed position of the valve generally in the direction of the axis of the housing. However, a configuration of the housing and of the floating body which differs from the rotationally symmetrical shape is equally possible. According to the features of claims 3 and 4, the valve seat can be disposed correspondingly in a plane extending perpendicular to the axis of the housing or to the longitudinal extension thereof.

The features of claims 4 and 5 are directed to the improvement in the guiding effect exerted upon the movement of the support disc. These features on the whole improve the reproducibility of the movements of the support disc, the integrity of the sealing effect and the smoothness of the said movements.

The invention will be explained in detail hereinunder with reference to the exemplified embodiment which is illustrated by way of example in the drawings, in which

Figure 1 shows an exploded view of the essential components of the bleed valve in accordance with the invention;

Figure 2 shows an axial sectional view of the bleed valve of Figure 1 in the open position;

Figure 3 shows an axial sectional view of the bleed valve of Figure 1 in the closed position;

Figure 4 shows an axial sectional view of the bleed valve of Figure 1 at the commencement of a new opening procedure;

Figure 5 shows a plan view of the floating body in accordance with a viewing direction V-V of Figure 1;

Figure 6 shows a sectional view and partial view of the installation state of the bleed valve.

Reference will be initially made hereinunder to Figures 1 to 2 and 5 of the drawings. As shown therein, the bleed valve consists of a cylindrical housing 1 which is closed off on the topside by means of a preferably detachably inserted cover 2, and of a generally likewise cylindrical floating body 3 which is disposed in the housing 1 in such a manner as to be able to move in the direction of the axis 5 thereof.

The floating body 3 can be guided in a non-rotatable manner inside the housing 1 in relation to the axis thereof by virtue of means which are known per se and are effective in a positive-locking manner.